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Printed or Typed Name: Barbara S. Pedersen
Signature: Barbara S Pedersen
Date of Deposit: 9-26-03

Title of Invention: VERTICLE FENCING

Inventor: Roger Walmsley
15 Gleneagles, Amington, Tamworth, B77 4NS, ENGLAND

VERTICAL FENCING

FIELD OF THE INVENTION

This invention relates to vertical fencing, and in particular to bow-top vertical fencing.

BACKGROUND TO THE INVENTION

Vertical fencing has been known for a number of years. This fencing comprises (in use) a plurality of vertical fence members which are supported by two substantially horizontal rails, a rail being located adjacent to the top and bottom of the fence members. The fencing is adapted as security fencing to prevent access by unauthorised persons, and so the fence members are sufficiently closely spaced to prevent such access. Typically, the fence members are of a length to prevent or reduce the likelihood that the fence can be climbed, and the rails are positioned sufficiently far apart to impair their use as a climbing aid for a person wishing to climb over the fence. In addition, the fence members typically project beyond the top rail, and their free ends can carry spikes or other features (which may be partly decorative), which spikes or features act to dissuade a person from climbing over the fence.

Whilst it is usually desirable that the fence members be precisely vertical, it is understood that some deviation from the vertical might be expected in some situations, and the term "vertical" used herein should not be interpreted to mean precisely vertical.

Bow-top vertical fencing is a particular type of vertical fencing in which each pair of adjacent vertical members are joined together by a "bow" at the top, so that each "fence member" of a bow-top fence comprises a pair of vertical members joined at their tops, resembling an elongated and

inverted "U". In the following description, each vertical member (corresponding to a side of the "U") will be referred to as a "leg" of a fence member. To distinguish from bow-top fence members, the substantially linear vertical members of fencing in which each vertical member is independent of its neighbours will be referred to herein as "separate fence members".

Vertical fencing is typically manufactured in sections, each section comprising a number of fence members and two rails. The sections are manufactured off-site and are then transported to the fence site. The rails are adapted to be connected to posts which are erected on the fence site at spaced positions along the line of the fence, two adjacent posts supporting either end of the rails of each section.

If the fence is at a site at which the ground is flat and horizontal the fence members can be permanently secured to the rails (as by welding), and can be exactly perpendicular to the rails, so that in the assembled fence the rails are horizontal and the fence members are vertical. However, it is often the case that the ground at the fence site is not flat and/or horizontal, so that if permanently secured fence members are used it is necessary to "step" the fence, i.e. to have one section higher or lower than an adjacent section to follow the slope of the ground. Such stepping is often visually unacceptable to the fence builder or architect. In addition, such stepping produces difficulties in fitment of the sections to the posts; thus, often the fitting means for the rails are pre-secured to the post(s), and it is difficult or impossible accurately to pre-secure the fitting means if the positions of these vary according to the slope of the ground adjacent the erected post location.

To overcome these difficulties, it is desired that the fence follow the contours of the ground, i.e. whilst the fence members remain vertical the rails can be pivoted relative thereto so that the rails are no longer perpendicular to the

fence members but can be substantially parallel to the (non-horizontal) ground. A fence section in which the fence members can pivot relative to the rails is referred to as "self-adjusting". Typically, up to 20° of pivoting movement can be accommodated by self-adjusting vertical fencing.

DESCRIPTION OF THE PRIOR ART

Self-adjusting vertical fencing systems for use with vertical fencing having separate fence members have been known for many years. One such system is known in the trade as "Nibal", and in this system the fence members are fitted to the rails by way of apertures in the rails; the fence members are then crimped (or "ribbed") adjacent the apertures so that subsequent removal from the rail is prevented. However, the crimping allows sufficient flexibilty in the joint between the fence members and the rails so that self-adjustment is possible. The "Nibal" system is shown in the 1930 catalogue of Baylis, Jones & Baylis, a well-known U.K. fencing manufacturer.

As described, the "Nibal" system relies upon the fence members being crimped. Traditionally, the fence members were of substantially circular cross-section solid steel bar 16 mm in diameter (or thereabouts). The substantial bar thickness was required to prevent adjacent bars being bent and separated, which could permit access through the fence. A fencing section would comprise two rails and perhaps twenty bars, and clearly such fencing sections were extremely heavy and so difficult and expensive to transport from the manufacturing location to the fence site.

Nowadays, it has become customary to use tubes as the fencing members rather than solid bars, the tubes being of a diameter and wall thickness sufficient to prevent or reduce the likelihood of bending and yet offering a substantial decrease in weight over an equivalent strength bar. Thus,

"vertical bar fencing" has been largely replaced by "vertical tube fencing".

However, it has not been found possible reliably to crimp the tubes used for vertical tube fencing, so that the "Nibal" system is not practical for self-adjusting vertical tube fencing.

Our granted U.K. patent 2,345,303 (and the corresponding European patent application 1 016 768) disclose vertical fencing in which the tubular, separate, fence members can pivot relative to the rails by way of at least one resiliently-biassed projection carried by the fence member, which resliently-biassed projection engages a recess in the rail.

An improvement upon our earlier applications is desired so that the benefits of the arrangements described therein can be enjoyed in applications utilising bow-top fencing.

DISCLOSURE OF THE INVENTION

The present invention therefore seeks to provide self-adjusting bow-top vertical tube fencing.

According to the invention, there is provided vertical fencing comprising a pair of rails and a plurality of tubular bow-top fence members attached thereto, each fence member comprising a pair of interconnected legs, the rails being pivotable relative to the fence members, characterised in that each leg of a fence member has connecting means by which it may be connected to at least one of the rails, and in that at least one of connecting means is movable relative to the longitudinal axis of the fence member.

Preferably, the movement of said at least one of the connecting means is limited, so limiting the angle through

which the rails can pivot relative to the fence members. Preferably also, said at least one of the connecting means engages a slot in a leg of the fence member.

Preferably also, the other connecting means is(are) substantially immovable relative to the longitudinal axis of the fence member. Said other connecting means engage(s) a hole in the other leg of the fence member, the hole being sized to be only slightly larger than the connecting means.

The provision of a connecting means being movable relative to the longitudinal axis of the fence member (for example by way of a slot through which it projects) allows vertical movement of a leg of the fence member relative to the rail, the fence member pivoting relative to the rail about the other connecting means.

Preferably, when said other connecting means is engaged with the respective rail movement of a leg of the fence member relative to the rail in the direction parallel to its longitudinal axis is limited. Accordingly, unauthorised removal of the fence member from the rail or rails is deterred or prevented.

Desirably, each connecting means should provide a sufficiently tight fit with the rail so that when the fence is erected longitudinal movement of the fence members is substantially prevented, so that the possibility of rattling of a fence member relative to the rails is prevented or reduced.

Preferably, the connecting means comprises a resiliently-biassed projection. Preferably also, at least one of the rails includes recess means with which the resiliently-biassed projection is engageable. Less preferably, the connecting means comprises a rivet or bolt passing through a part of the rail and a part of the fence member.

Desirably, at least one of the rails comprises a channel section, the recess means being provided by a notch or hole in an inturned part of the section. Accordingly, the recess means can be substantially invisible when the fence section has been assembled, so that subsequent unauthorised removal of the resiliently-biassed projection from the recess is substantially or totally prevented.

Preferably, each resiliently-biassed projection is provided by a spring clip; preferably also the body of the clip is located within the fence member.

Preferably, one leg of the fence member carries two resiliently-biassed projections, each of these resiliently-biassed projections projecting through a respective hole in the leg. Desirably, the other leg carries one resiliently-biassed projection projecting through the slot.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Fig.1 is a perspective view of part of a self-adjusting bow-top vertical fence section secured to a post;

Fig.2 is a sectional view of a leg of a fence member and rail which are connected together by way of a resiliently-biassed projection projecting through a hole;

Fig.3 is a sectional view of a leg of a fence member and rail which can be connected together by way of a resiliently-biassed projection projecting through a slot;

Fig.4 is a side view of the leg of the fence member of Fig.3;

Fig.5 is a perspective view of part of the rail of Figs. 1-3;

Fig.6 is a plan view of part of the rail of Fig.5; and

Fig.7 is a sectional view of a leg of a fence member and rail connected together by way of a rivet passing through a slot;

DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

In the following description, directional and orientational terms such as "top", "bottom" etc. refer to the orientation of the components as drawn, which will typically also be the orientation of use.

The vertical fence section 10 (part of which is shown in Fig.1) comprises two rails 12,14 to which a number of bow-top fence members 16 are attached. The rails 12,14 are both connected to a post 18 in known fashion. The fence is self-adjusting, so that the angular relationship between the rails 12,14 and the fence members 16 is not fixed, and the angle α between these components can be adjusted (within design limits) to suit the slope of the ground adjacent to the erected fence.

The fence members 16 comprise a pair of legs 20,22 interconnected together; in this embodiment the interconnection is by way of a curved section 24. Each fence member 16 may for example be manufactured from a single tube bent through 180^{o} at its centre.

Typically, an assembled fence will comprise a number of fence sections 10, each fence section being connected to posts 18 by way of the ends of the rails 12,14. The posts 18 define the line of the fence and are erected on the site. The fence sections 10 are generally pre-assembled i.e. manufactured off-site and supplied to the site ready for connection to the posts. A fence section 10 can for example have between ten and twenty fence members 16, spaced so as to prevent the access of a person therebetween.

As above described, to permit the fence to follow the contours of the ground, it is desirable that the rails can pivot relative to the fence members, i.e. the angle α can vary from 90^{o} as in the embodiment of Fig.1 (this angle does not appear as 90^{o} in the drawing because of the perspective), perhaps varying by as much as 20^{o} on particularly sloping ground.

The pivotable or adjustable attachment of the leg 20 of the fence member 16 to a rail is shown in Fig.2 (this attachment corresponds to the disclosure of our U.K. patent 2,345,303). In Figs.2 and 3 the rail is given a different reference numeral (40), since it could be the top rail 12 or the bottom rail 14 of Fig.1, or both.

The rail 40 is of channel section and its side walls 42 each have an inturned part 44, the inturned part 44 terminating adjacent the wall 46 and having a recess in the form of a notch 50 (see also Fig.5) in the inturned part 44. In the embodiment shown, both inturned parts 44 have a notch 50, and these notches 50 are aligned.

The leg 20 carries a spring clip 52, the ends 54 of which can project through opposed openings 56 in the wall 58 of the tubular frame member. In this embodiment the spring clip 52 is of stainless steel with a circular cross-section having an outer diameter of approximately 4 mm; the diameter of the openings 56 is slightly greater than 4 mm. The

action of the clip is resiliently to bias the ends 54 of the clip out of the openings 56, i.e. a force is required to push the ends 54 into the frame member 20.

In other embodiments the clip is of carbon steel or any other suitable material, perhaps even a plastics material, having the desired resilience and strength.

As seen in Fig.6, the wall 46 of the rail 40 has an elongated aperture 60, the elongation being required to permit the required amount of pivoting of the fence member 16 relative thereto.

Fig.3 is a similar view to that of Fig.2 but of the connection between the rail 40 and the leg 22 of the fence member 16. In Fig.3 the spring clip is not present, but it will be understood that a spring clip or other suitable connecting means would be present, suitably a spring clip identical or similar to that of Fig.2. The ends of the spring clip would project through the aligned slots 26 into engagement with the respective notches 50 in the rail 40.

As also seen in Fig.4, each slot 26 has a length L many times greater than its width, and correspondingly many times greater than the diameter of the end 54 of the spring clip. Accordingly, the ends of the spring clip (and consequently the rail 40) are allowed a considerable degree of movement relative to the leg 22, in the longitudinal direction A of the leg 22 and fence member 16.

It will therefore be understood that the leg 20 of each fence member 16 is substantially fixed in its (longitudinal) position relative to the rail 40, whilst the leg 22 is allowed some longitudinal movement. The rail 40 and fence member 16 can therefore be pivoted relative to one another so that the fence section 10 is self-adjusting. The angle α through which the relative pivoting can occur is determined by the length L of the slot 26 and the separation S between

the legs 20,22. The separation S will typically be fixed by the architect or designer, whilst the length L can be chosen to suit the pivoting angle required. However, the maximum length of the slot should be chosen to be small enough to prevent the whole of the spring clip passing through the slot.

To assemble the fence members 16 to the rail 40, the spring clips (such as 52) of each leg 20,22 can be first inserted into the end of the respective leg 20,22 by a suitable tool. The tool can either maintain the clip in its stressed condition (i.e. with the ends 54 held closer together than the inner diameter d of the respective leg), or alternatively (and more simply), the clip can be located adjacent the openings 56 but not aligned therewith, so that the clip is maintained in its stressed condition by the wall 58. The frame member 16 is moved into position relative to the rail 40. When correctly positioned, with the openings 56 and slots 26 substantially aligned with the respective notches 50, the clips 52 are moved within the legs 20,22 so that the ends 54 are aligned with the respective openings 56 and slots 26, and the ends 54 are caused by the resilience of the clip 52 to project therefrom into the respective notches 50. In the event that the openings 56 or slots 26 are not correctly aligned with the respective notches 50, the ends 54 of the clip 52 may undergo two-stage movement, i.e. projecting from the fence member 16 until they engage the inturned parts 44, whereupon the frame member 16 or rail 40 will require to be moved until the ends 54 of the clip 52 can spring into the respective notches 50.

Alternatively, the rails and frame members can be placed in their (approximate) assembled positions before insertion of the spring clips into the respective legs of the frame member, the ends of the spring clips being allowed to project through the respective hole 56 or slot 26 into the respective notch 50.

It is arranged that in the assembled condition shown in Fig.2, the difference between {i} the dimension "a", i.e. the "depth" of the notch 50 between its bottom edge and the underside of the wall 46 of the rail 40, and {ii} the diameter of the end 54 of the clip 52, is as small as possible, perhaps 1 mm or even less. This difference determines the maximum amount of "free" movement of the leg 20 along its longitudinal axis A, and as previously described this should be as small as possible to reduce the possibility that the fence member can be rattled.

It is also arranged that the lateral dimension of the notches 50 only slightly exceeds the corresponding diameter of the end 54 of a clip 52, so that lateral movement of the frame member 16 is substantially prevented by engagement of the ends 54 of the clip 52 with the sides of the notches 50.

Clearly, the spring clip could be other than of circular cross-section, and if so references herein to "diameter" should be amended accordingly.

It has been determined that for a fence member 16 having tubular legs 20,22 of 25 mm outer diameter, an aperture 60 (Fig.6) of a width w of 26 mm and a length l of 30 mm, will provide up to approximately 20^{o} of pivotting movement, for a rail formed of 2 mm thick channel section.

It will be understood that the dimension "b" of Fig.2 can be as small as desired, i.e. the distance between the inturned parts 44 of the side walls 42 need be only slightly greater than the thickness of the fence member; accordingly, access for a person's fingers (or more likely a tool) to force the end 54 of the clip 52 out of the notch 50 could be substantially prevented. Even with a relatively large dimension "b", visual inspection of the attachment is difficult to obtain on an assembled fence, so that a person intent on removing one or more fence members will be significantly encumbered.

It will be understood that several alternative forms of rail, and in particular alternative forms and locations of recesses therein, can be utilised as desired.

The arrangement of Figs. 2-6 has considerable practical benefits, including in particular that the connecting means (i.e. the spring clip 52) is invisible in the assembled fence. This makes the fence more difficult to attack for a person intent on removing one or more of the fence members. However, such security is not always required, and part of another embodiment which does not share this benefit is shown in Fig.7.

Fig.7 shows the connection of a leg of a bow-top fence member such as that referenced 16 in Fig.1 to a rail 140 of box-section. The rail 140 has an aperture 160 in its top and bottom walls shaped similarly to the aerture 60 of Fig.6. The length of the apertures is determined according to the degree of pivoting movement desired. The leg 122 has a slot 126 formed therein, the length of the slot 126 also being determined by the degree of pivoting desired and the spacing between the legs of the fence member.

In this embodiment the connecting means joining the leg to the rail is a rivet 62 which passes through appropriately-sized preformed openings in the sides of the rail 140, and through the slot 126 in the leg 122. The width of the slot 126 is slightly greater than the thickness of the rivet, so that the rivet 62 can slide substantially freely within the slot 126.

It will be understood that the ends 64 of the rivet are visible in the assembled fence, and therefore vulnerable to attack, but that may be acceptable in some lower-security applications. Also, it will be understood that the rivet may be replaced by a bolt or other suitable connecting means.

To limit the longitudinal movement of the fence member in this embodiment, the other leg of the fence member will have openings through which a rivet or bolt may be passed, i.e. as with the embodiment of Figs. 2-6 one leg of the fence member is allowed relative longitudinal movement by virtue of the slot 26, 126, whilst relative longitudinal movement of the other leg is limited or prevented.

It will be appreciated that the exact form of the rail in the embodiment of Fig.7 is not critical, and the box-sectional rail(s) could be replaced by channel section rails without affecting the method of assembly or use.

In both of the described embodiments it could be arranged that there is a single connection of each leg to a respective rail, i.e. both legs could be connected to the bottom rail 14 or to the top rail 12, or one of the legs could be connected to the top rail 12 and the other to the bottom rail 14. Alternatively, and desirably, the leg 20 is connected to both rails 12 and 14 by way of spring clips 52 or rivets 62 (for example) passing through openings such as 56 in the leg. The securement of one of the legs to both rails helps to maintain the desired separation of the rails.

Additionally, if desired the leg 22, 122 could be connected (by way of spring clips or rivets passing through respective slots 26, 126 for example) to both rails, but this is not believed to be necessary in most applications.

It is therefore possible that the fence member could be "loose" relative to one of the rails, i.e. merely passing through an aperture 60, 160 therein to provide lateral stability, the attachment to the other rail limiting the movement of the fence member.

It has been recognised that the fence members 16 can be fitted to the rails 40, 140 after painting of the fence

members and rails, i.e. because no welding or other heat treatment is required to attach the fence members to the rails, any pre-applied paint will not be damaged. Accordingly, it is possible with vertical fencing according to the invention to have differently coloured fence members (perhaps alternately coloured) in the or each fence section, increasing the architect's or designer's freedom of choice in the aesthetic appeal of the bow-top fence.

In addition, it is possible to fit the fence members to the rails "on-site", or more practicably at a site located away from the manufacturing location. This latter advantage provides significant benefit for reducing transportation costs, since the frame members and rails can be supplied separately, and perhaps even exported, for local assembly, so avoiding the transportation of much wasted space which is common with pre-assembled fence sections.

The material from which the rails are manufactured would typically be a metal. Steel is a suitable material, as is aluminium, though other materials are likely to be suitable also.